

MATHEMATICS LESSON PLAN

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Date: March 2013

1. Name of the lesson: **Golden Apples**

A prince picked a basketful of golden apples in the enchanted orchard. On his way home, he stopped by a troll who guarded the orchard. The troll demanded payment of one-half of the apples plus two more. The prince gave him the apples and set off again. A little further on, he was stopped by a second troll guard. This troll demanded payment of one-half of the apples the prince now had plus two more. The prince paid him and set off again. Just before leaving the enchanted orchard, a third troll stopped him and demanded one-half of his remaining apples plus two more. The prince paid him and sadly went home. He had only two golden apples left. How many apples had he picked?

2. Concept/Topic: Algebra 1 Linear Equations

3. Grade Level: 7th -12th (2-3 50-60 minute class periods)

4. Goals and learning objectives: Students will be able to use problem solving strategies to derive the linear equation of a mathematical task that fosters algebraic thinking. Abstracting from Computation.

5. Common Core Content Standards:

- Solve real-life and mathematical problems using numerical and algebraic expressions and equations. (7.EE.3-4▲)
- Understand the connections between proportional relationships, lines, and linear equations. (8.EE.5)
- Create equations that describe numbers or relationships (A-CED.2)
- Represent and solve equations and inequalities graphically A-REI.10)

6. Standards of Mathematical Practice: (*list by number and title*)

- 1 Make sense of problems and persevere in solving them.
- 2 Reason abstractly and quantitatively.
- 3 Construct viable arguments and critique the reasoning of others.

6 Attend to precision.

7. Prerequisites:

- a. What do the students need to know prior to the lesson? Students need to know problem solving strategies such as doing-undoing, working backwards, guess and check. Students need to know inverse operations.
- b. What vocabulary do we need to think about?
Inverse, Remainder,
- c. What do students struggle with?
 - i. Students struggle with finding a starting point.
 - ii. Students struggle with the operations depicted in the task and the order in which they are done.
 - iii. Students struggle with multi-step problems.
 - iv. Students struggle with keeping their work organized.
 - v. Students struggle with clearly displaying their thinking.
- d. What are their misconceptions prior to the lesson?
 - i. Story problems/tasks are hard.
 - ii. Run on math sentences.

8. Required Materials:

- Copy of Task
- Poster Paper
- Markers
- Manipulatives

9. Resources:

Fostering Algebraic Thinking, Driscoll, 1999

10. Process of the lesson:

Steps/Time	Learning Activities and Teachers' Questions	Anticipated Student Responses and Misconceptions	Teacher's response to student reactions / Things to remember	Checking for Understanding (Evidence of Student Learning)
Introduction (2 min)	Students read problem and write down any ideas for solving and questions that need to be clarified.		What's the task asking you to find?	
Guided Discovery – groups of 2 to 4 (20 min)	<ul style="list-style-type: none"> Students will work collaboratively to make sense of the task and devise a plan on how to find a solution. Students will begin their plan and if necessary make revisions to their work. Students will check in with teacher for discussion of solution before creating poster. 	<ul style="list-style-type: none"> Students may not use inverse operations when working backwards. Students may not use inverse operations in the correct order. Students may not be able to find an access point. (This is where acting it out or using manipulatives will facilitate a starting point. 	<ul style="list-style-type: none"> How did you get that value? How can you check your answer? How do you explain that? What strategies have you tried? 	<p>Clarifying questions asked by teacher and student responses.</p> <p>Student revisions to previous work.</p>
Whole Class Discusion	Teacher will select student groups to share their thinking and work. Teacher selection will be based on strategies used, work completed and progress of achieving an equation/graph. Teacher will guide the discussion as each group shares.	Students may not agree that other options are available to work this problem.	<ul style="list-style-type: none"> Does anyone have a different way? How are things changing? Is there constant rate of change? Can you write a rule for this? How can we 	Clarifying questions asked by teacher and student responses.

			find the minimum number of apples needed? <ul style="list-style-type: none"> • How do we come up with this rule? • Does the rule work for every instance? • How can we check? 	
Closure (5 min)	3-2-1 List 3 things that became clearer/solid for you today. List 2 things that you are proud of from your work. List 1 thing that would help your group become more collaborative.			

11. Plan for Independent Practice/Homework:

Write a summary of your learning.

Do the same problem but each troll is demanding a payment of one-half plus 4. How does this change the problem?

12. Adaptations/Extensions:

What if he had 4 left? How many did he begin with?

What if he had 6 left? How many did he begin with?

What if the trolls demanded a payment of one third plus 2, how would the problem change?

13. Possible connection to other subjects and or mathematical concepts: